

Nautiliniellid Polychaetes Collected from the Hatsushima Cold-Seep Site in Sagami Bay, with Descriptions of New Genera and Species

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ABSTRACT—Polychaete species belonging to the family Nautiliniellidae were found in the mantle cavities of two bivalve species collected from the Hatsushima cold-seep site in Sagami Bay at a depth of 1170 m. As a result of the comparison with *Nautiliniella calyptogenicola*, new combination, two new genera and two new species are described. The new genus *Shinkai* differs from the type genus of the family in having only one pair of prostomial antennae instead of two pairs. *Shinkai sagamiensis* new species is parasitic on *Calyptogena soyae*. *Natsushima bifurcata*, new genus and species, differs from all other species of the family by the presence of additional numerous bifurcate setae on each parapodium instead of the exclusive presence of simple hooks in the others. This species is parasitic in the mantle cavity of an undescribed bivalve species of the genus *Solemya*. The position of the family Nautiliniellidae is discussed, after a reexamination of the type specimens of *Antonbruunia viridis*.

The polychaete family Nautiliniellidae characterized by simple ventral hooks, was proposed with the description of a single representative species, *Nautilina calyptogenicola* Miura & Laubier, 1989 [1]. However, the classification of the family has not been deeply discussed because of the scarcity of the knowledge on the Japanese cold-seep community and on the parasitic polychaetes on bivalves. In the course of the serial dives of the deep-sea submersible "Shinkai 2000" of the Japan Marine Science and Technology Center, the first author (T.M.) could dive at the *Calyptogena soyae*-dominant community of the Hatsushima cold-seep site [2] which may be comparable to the *Calyptogena phaseoliformis*-dominant sites of the Japan Trench [3, 4]. During Dives 315, 316 and 381 of the submersible "Shinkai 2000" at depths of 1100 to 1200 m, many specimens of cold-seep bivalves and vestimentiferans were collected. The parasites and associated invertebrates living on these cold-seep animals were removed from their hosts on the mother ship, "Natsushima" and two

polychaete species of the family Nautiliniellidae, a species of the family Phyllodocidae and a species of poecilostomatoid copepod were found [5, 6]. In this paper, these two new species and new genera of the nautiliniellid polychaetes parasitic in the mantle cavity of cold-seep bivalves are described and a new name is also proposed for the previously described genus for reason of the preoccupation.

The types are deposited in the National Science Museum, Tokyo (NSMT) and the Japan Marine Science and Technology Center (JAMSTEC).

Nautiliniellidae

Type genus: *Nautiliniella*, new genus with the type species *Nautilina calyptogenicola* Miura and Laubier, 1989, by monotypy.

Nautiliniella new genus

Type species: *Nautilina calyptogenicola* Miura and Laubier, 1989, by monotypy.

Remarks: The generic name *Nautilina* is preoccupied in a molluscan species and in a protozoan species (after Nomenclator Zoologicus). The new generic name *Nautiliniella* is proposed here. A

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newly combined name, *Nailiniella calyptogenicola* is also proposed for the previously described species, *Nautilina calyptogenicola*.

Shinkai new genus

Type species: *Shinkai sagamiensis*, new species, by monotypy. Gender feminine.

Diagnosis: Body long, vermiform, tapering posteriorly with numerous setigerous segments; body in cross-section flattened ventrally and more or less arched dorsally. Prostomium short with a pair of antennae, without eyes. Muscular proventriculus present. Achaetous peristomial ring absent. First setiger more or less fused with prostomium. Parapodia subbiramous with dorsal and ventral cirri; dorsal cirri well developed; ventral cirri very short; neuropodia with a single embedded acicula and a few simple stout hooks. Pygidium cylindrical without appendage.

Etymology: The genus is named in the honor of the submersible "Shinkai 2000" of the JAMSTEC with which the host bivalves of the parasitic polychaetes were collected during Dives 315 and 381.

Remarks: Species of the new genus *Shinkai* resemble *Nautiliniella calyptogenicola* in having a dorsally arched body in cross-section, a muscular proventriculus and ventral simple hooks. However they differ from the latter in having only one pair of prostomial antennae instead of two pairs.

Shinkai sagamiensis, new species

(Fig. 1)

Materials: Holotype (NSMT-Pol. H-293), complete with regenerated posterior segments, off Hatsushima, Sagami Bay 34°00.0'N, 139°13.8'E, 1170 meters, 19 November 1987, deep-sea submersible "Shinkai-2000" Dive 315, collected from the mantle cavity of *Calyptogena soyoe*. Paratypes (JAMSTEC), one anterior fragment, same station as the holotype, from washings and sievings of sediment with *C. soyoe* collected by a power-driven grab; one complete, same site, 5 November, 1988, Dive 381, washings.

Measurements: Holotype, 14 mm long, 1.0 mm wide including parapodia, with 65 setigers (38

anterior segments and 27 regenerated segments). Larger fragmental paratype, 8.0 mm long, 1.2 mm wide, with 32 anterior setigers.

Description: Body vermiform, flattened ventrally and slightly arched dorsally. Integument smooth. Specimens preserved in alcohol pale or colorless.

Prostomium very short, anteriorly incised, with a pair of very short cirriform antennae, without eyes or other appendages (Fig. 1a, b). Achaetous peristomial ring absent. Mouth opening situated ventrally, between prostomium and first setiger. Ventral cirri of first setiger larger than followings, inserted in front of neuropodia (Fig. 1f). Foregut with well-developed muscular part (may be proventriculus).

Pygidium cylindrical, without anal cirri (Fig. 1c).

Parapodia subbiramous, with well-developed dorsal cirri and much reduced ventral cirri; first dorsal cirrus greatly reduced; first ventral cirrus located in front of neuropodial fascicle; bases of dorsal cirri swollen, forming globular pads with embedded slender notoacicula; dorsal cirri five times as long as ventral ones; neuropodia globular (Fig. 1d).

Setae consisting of simple ventral hooks only; several hooks projected from each neuropodium on anterior parapodia, e.g. 3–4 on parapodium 1, 5–8 on parapodia 2–6, 1–3 on parapodia 7–20, and 1 on posterior parapodia; several developing hooks embedded around acicula. Hooks simple, stout and strongly curved on very short distal end with remarkable knob (Fig. 1e).

Etymology: The specific name is derived from the type locality, Sagami Bay.

Natsushima new genus

Type species: *Natsushima bifurcata*, new species, by monotypy. Gender feminine.

Diagnosis: Body long, vermiform, tapering posteriorly with numerous setigerous segments; body in cross-section flattened ventrally and slightly arched dorsally. Prostomium short with a pair of antennae, without eyes. Muscular proventriculus present. Achaetous peristomial ring absent. Parapodia subbiramous with dorsal and ventral cirri;

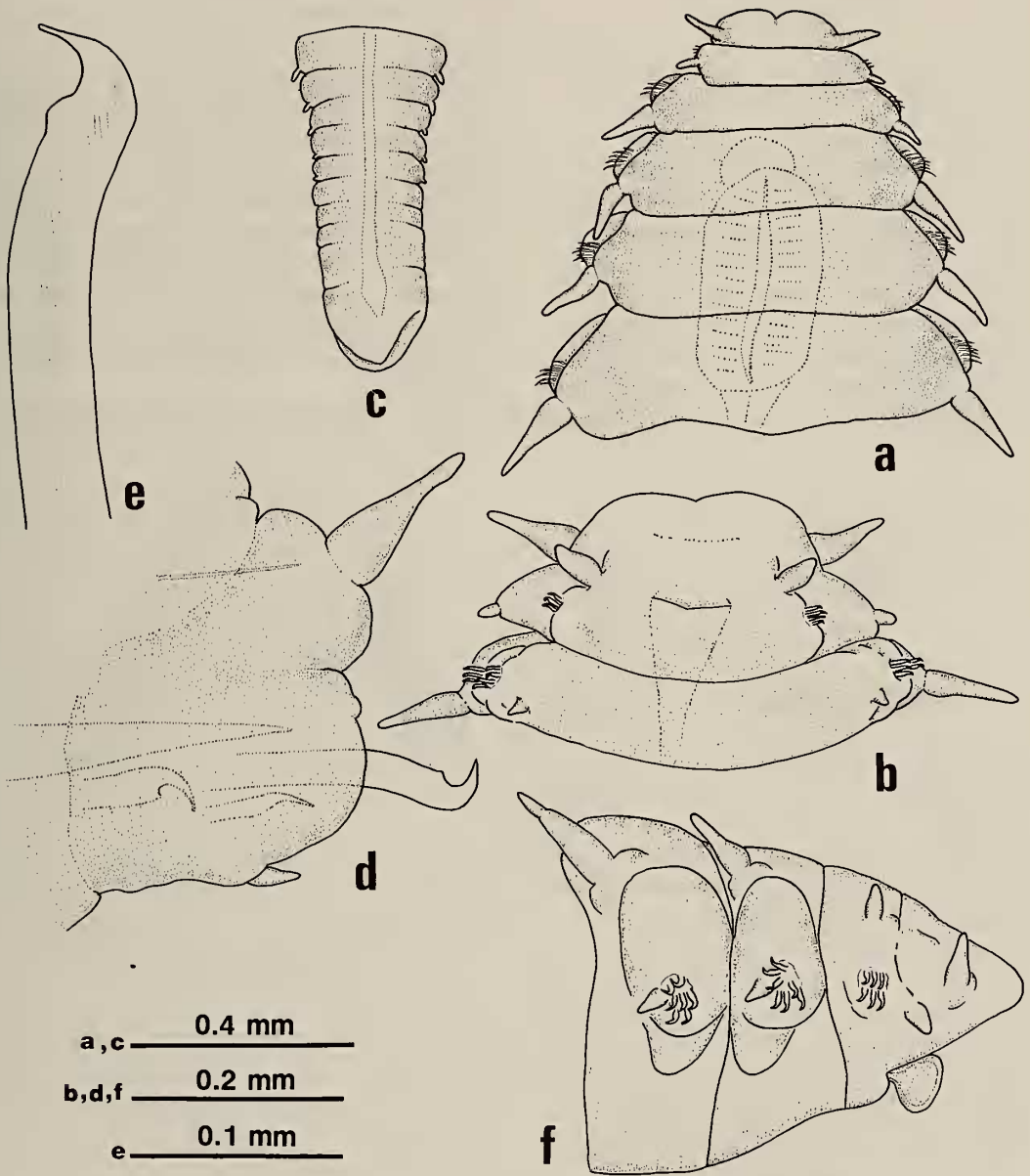


FIG. 1. *Shinkai sagamiensis* g. sp. n.: a, Anterior end, dorsal view (holotype); b, Same, ventral view; c, Pygidium, dorsal view; d, Parapodium 19, anterior view; e, Hook; f, Anterior end, lateral view (paratype).

dorsal cirri longer than ventral ones; neuropodium with a single embedded acicula, a few simple stout hooks and many bifurcate simple setae. Pygidium simple without appendage.

Etymology: The genus is named in the honor of the research vessel "Natsushima" of the JAM-STEAC, the mother ship of the submersible "Shink-

ai 2000".

Remarks: The new genus belongs to the family Nautiliniellidae in having subbiramous parapodia with characteristic simple ventral hooks, however the single species of this genus differs from those of other genera in having additional numerous smaller bifurcate setae on each parapodium instead of

exclusive presence of simple hooks.

Natsushima bifurcata, new species
(Fig. 2)

Material: Holotype (NSMT-Pol. H-294), complete, off Hatsushima, Sagami Bay, 34°00.0'N, 139°13.8'E, 1170 meters, 19 November 1987, deep-sea submersible "Shinkai-2000" Dive 315, collected from the mantle cavity of *Solemya* sp.

Measurements: Holotype 5.0 mm long, 0.6 mm wide including parapodia, with 47 setigers.

Description: Body vermiform, flattened ventrally and slightly arched dorsally. Integument

smooth. Specimens preserved in alcohol pale or colorless.

Prostomium very short, anteriorly slightly incised, with a pair of short cirriform antennae, without eyes or other appendages (Fig. 2a, b). Achaetous peristomial ring absent. Mouth opening situated between prostomium and first setiger, without jaws or paragnaths. First segment partially fused with prostomium. Foregut with well-developed muscular part, without tubiform pharynx.

Pygidium simple, rounded, without anal cirri (Fig. 2c).

Parapodia subbiramous throughout body, with

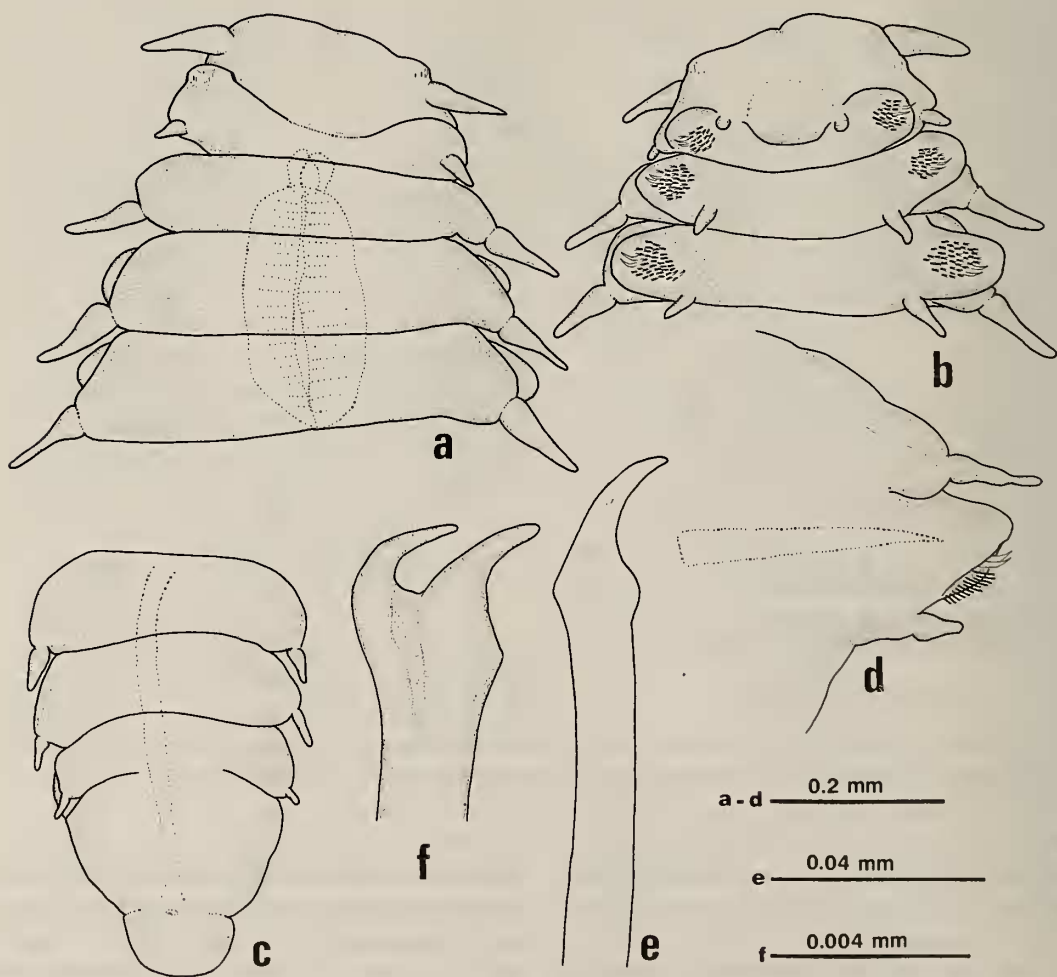


FIG. 2. *Natsushima bifurcata* g. sp. n. (holotype): a, Anterior end, dorsal view; b, Same, ventral view; c, Pygidium; d, Parapodium 16, anterior view; e, Hook; f, Bifurcate seta.

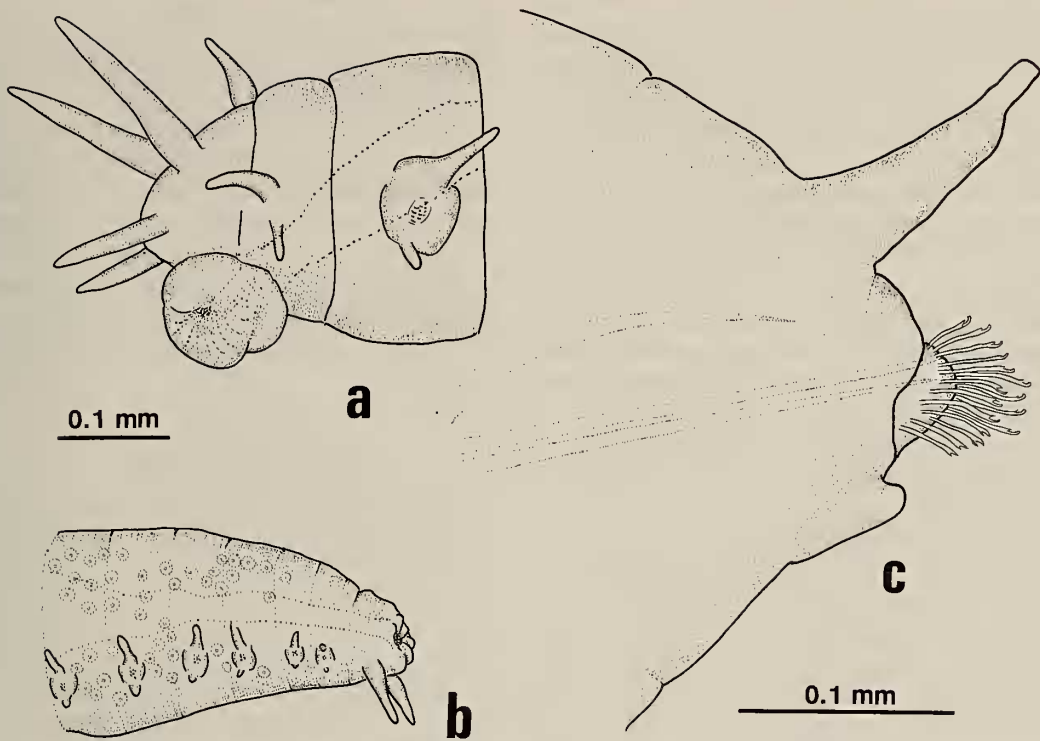


FIG. 3. *Antonbruunia viridis* Hartman and Boss, 1965 (Paratypes: USNM 56718): a, Anterior end, lateral view; b, Posterior end, lateral view; c, Posterior parapodium, anterior view.

well-developed dorsal and short ventral cirri; bases of dorsal cirri swollen, with very fine embedded notoacacula; dorsal and ventral cirri of first setiger reduced; neuropodia cylindrical (Fig. 2d).

Setae consisting of stout simple hooks and smaller bifurcate simple setae; a few hooks (2–4) projected from each setal lobe; several developing hooks embedded around acicula. Hooks simple, stout and slightly curved on distal end (Fig. 2e). Numerous smaller bifurcate setae situated below stout hooks. Distal teeth of bifurcate setae separated each other, strongly curved (Fig. 2f).

Etymology: The specific name is derived from the presence of bifurcate setae.

DISCUSSION

The single representative species of the family Antonbruuniidae Fauchald, 1977 [7], *Antonbruunia viridis* Hartman and Boss, 1965, is known as living in the mantle cavity of the bivalve *Lucina*

fosteri Hartman and Boss, 1965 [8]. This species resembles the nautiliniellid species in having simple body with subbiramous parapodia and commensal life. However, several important morphological differences between these two families were found from the original description of *A. viridis* and after the reexamination of four paratypes (USNM 56718) of this species. *A. viridis* has five occipital antennae including central unpaired one, while nautiliniellid species have one or two pairs of lateral antennae and lack the central one. There are a distinct achaetous periostomial ring with tow pairs of cirri and a pair of cylindrical anal cirri in the former (Fig. 3a, b), while those are absent in the latters. In *A. viridis*, each parapodium is supported by three similar acicula with bases adjoining or contacted one another. Two neuropodial acicula are directed to the setal fascicle and a single notopodial one to the base of dorsal cirrus but not penetrating inside the cirrus (Fig. 3c). The appearance of acicula in nautiliniellid species

completely differs from that of *A. viridis*. In nautiliniellid species, there are a single slender notoaciculum and a single thick neuroaciculum. The notoacacula of nautiliniellids are always situated apart from the neuroacacula and often embedded in the dorsal cirri. They are very thin compared with the neuroacacula. The setal composition is also different in these two families. Simple stout hooks are present in all nautiliniellid species but do not occur in *A. viridis*. *A. viridis* also exhibits clear sexual dimorphism, with dwarf males. This biological adaptation was not encountered in nautiliniellid species, which could be due to the small number of specimens collected.

The discovery of two new species enables to establish the morphological features of the family Nautiliniellidae on a more definitive basis. The major characters of the family are the presence of a muscular proventriculus, subbiramous parapodia and ventral simple hooks, and the absence of achaetous peristomial ring. Some pilargid polychaetes resemble the species of the family Nautiliniellidae in the characters mentioned above, with the exception of the typical pilargid notopodial acicular spines. The species of the genus *Litocorsa* have stout neuropodial spines [9–11]. Although the simplified nautiliniellid body recalls the species of the families Calamyzidae and Levidoridae as mentioned in our previous paper [1], the compound setal structure in these families was not found in the nautiliniellid species. The simple setae of the family Levidoridae are thought to be derived from compound setae by fusion of shafts and blades [12], while the typical ventral simple hooks of nautiliniellids may have originated from simple ventral spines or setae, like the neuropodial spines of *Litocorsa*. The simple structure of typical nautiliniellid ventral hooks may be an important character supporting a hypothetical relation of the family Nautiliniellidae with the Pilargidae.

It was clarified above that the nautiliniellid polychaetes may have another type of setae beside the ventral simple hooks. The simple bifurcate setae of *Natsushima bifurcata* rather recall those of the family Oweniidae than the others. Nilsen and Holthe discussed the phylogenetical development of the typical oweniid uncini with two equal teeth

and considered that they might have derived from the typical long-shafted uncini found in several sedentary families [13]. The shafts of these uncini are long and curved with distinct narrow parts called "neak" [13, 14], and completely separated from the nautiliniellid straight setae without neck. The nautiliniellid bifurcate setae may have independently evolved in the pathway to the parasitic life.

As a conclusion, even if there may still be some doubt, the family Nautiliniellidae should be placed in the order Phyllodocida, near the family Pilargidae.

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REFERENCES

- 1 Miura, T. and L. Laubier (1989) *Nautilina calyp-togenicola*, a new genus and species of parasitic polychaete on a vesicomid bivalve from the Japan Trench, representative of a new family Nautilinidae. Zool. Sci., 6: 387–390.
- 2 Okutani, T. and K. Egawa (1985) The first underwater observation on living habit and thanatocoenoses of *Calyptogena soyoe* in bathyal depth of Sagami Bay. Venus (Japan. J. Malacol.), 44: 285–289.
- 3 Métivier, B., T. Okutani, and S. Ohta. (1986) *Calyptogena (Ectenagena) phaseoliformis* n. sp., an unusual vesicomid bivalve collected by the submersible Nautile from abyssal depths of the Japan and Kurile Trenches. Venus (Japan. J. Malacol.), 45: 161–168.
- 4 Ohta, S. and L. Laubier (1987) Deep biological communities in the subduction zone of Japan from bottom photographs taken during "nautile" dives in the Kaiko project. Earth Planet. Sci. Lett., 83: 329–342.
- 5 Miura, T. (1988) Parasitic animals collected in a *Calyptogena*-dominant community developing off Hatsushima, Sagami Bay. JAMSTECTR Deepsea

- Res., 4: 239–244. (In Japanese).
- 6 Miura, T. (1988) A new species of the genus *Protomystides* (Annelida, Polychaeta) associated with a vestimentiferan worm from the Hatsushima cold-seep site. Proc. Japan. Soc. Syst. Zool., 38: 10–14.
 - 7 Fauchald, K. (1977) The polychaete worms. Definitions and keys to the orders, families and genera. Nat. Hist. Mus. Los Angeles Cty., Sci. Ser., 28: 1–190.
 - 8 Hartman, O. and K. J. Boss (1965) *Antonbruunia viridis*, a new inquiline annelid with dwarf males, inhabiting a new species of pelecypod, *Lucina fosteri*, in the Mozambique Channel. Ann. Mag. Nat. Hist., ser. 13, 8: 177–186.
 - 9 Pearson, T. H. (1970) *Litocorsa stremma* a new genus and species of pilargid (Polychaeta: Annelida) from the west coast of Scotland, with notes on two other pilargid species. J. Nat. Hist., 4: 69–77.
 - 10 Wolf, P. S. (1986) Three new species of Pilargidae (Annelida: Polychaeta) from the east coast of Florida, Puerto Rico, and the Gulf of Mexico. Proc. Biol. Soc. Wash., 99: 464–471.
 - 11 Imajima, M. (1987) Pilargidae (Annelida, Polychaeta) from Japan (Part 1). Bull. Natn. Sci. Mus., Tokyo, Ser. A, 13: 151–164.
 - 12 Perkins, T. H. (1987) Levidoridae (polychaeta), new family, with descriptions of two new species of *Levidorum* from Florida. Bull. Biol. Soc. Wash., 7: 162–168.
 - 13 Nilsen, R. and T. Holthe (1985) Arctic and Scandinavian Oweniidae (polychaeta) with a description of *Myriochele fragilis* sp. n., and comments on the phylogeny of the family. Sarsia, 70: 17–32.
 - 14 Imajima, M. and Y. Morita (1987) Oweniidae (Annelida, Polychaeta) from Japan. Bull. Natn. Sci. Mus., Tokyo, Ser. A, 13: 85–102.